## REMARKS

The subject invention relates to optically pumped semiconductor (OPS) lasers. In these devices, a semiconductor chip is formed with a multi-quantum well gain medium (12) and an attached resonator mirror (14). An external mirror (not shown in the drawings) defines the resonator. The surface of the gain medium is optically pumped to generate laser light.

Continuing efforts are being made to increase the output power of these OPS lasers. As the power levels increase, it becomes more important to remove heat from the gain structure. In the past, it has been known to bond a copper heat sink to the OPS chip to remove heat. To improve heat flow, it has also been known to adhesively bond a diamond heat spreader between the OPS chip and the copper heat sink. Adhesive or solder bonding is simple and inexpensive but has certain problems. First, the solder is not particularly thermally conductive and thus restricts the heat flow from the chip to the heat sink. Further, when heated, the solder can produce stresses between the bonded elements that can alter optical properties and even result in cracks in the chip.

To overcome these problems, applicants began investigating bonding the chip to the heat sink without adhesive. The solution to the problem was to use a contact bond. Such a bond is achieved if two extremely clean, extremely smooth surfaces are brought together under pressure. If the surfaces are smooth enough, atomic forces (van der Waal forces) from one surface attract the other surface making an extremely strong, virtually unbreakable bond.

As noted in the specification at page 5, line 9 and again on page 10, line 23, although not required, the assembly can be heated to anneal the materials to improve the strength of the bond. It is believed that the annealing step may function to reduce stress and improve the close contact needed to create the bond. The specification defines the preferred temperature range for heating the assembly as between 100 to 350 degrees centigrade which is far below the melting point of the materials. For example, a semiconductor material such as Gallium Arsenide would have a melting point greater than 1000 degrees centigrade while the melting point of diamond is over 3000 degrees centigrade. Heating the assembly to 350 degrees centigrade is not intended to cause the elements to melt and fuse. Indeed, heating the assembly to a temperature anywhere close the melting point would destroy the crystalline structure of the semiconductor rendering it inoperative.

Turning to the Office Action, the Examiner rejected claims 1 to 6, 10, 11 and 13 based on the commonly owned patent to Salokatve (6,327,293) in view of Karp (2004/0238052). There is no dispute that Salokatve discloses the basic structure of an optically pumped semiconductor (OPS) laser where the heat sink is bonded to the semiconductor structure using an adhesive.

The Examiner cites the publication to Karp for its teaching of bonding materials with pressure without adhesive. The Examiner states it would have been obvious for one of ordinary skill in the art to apply the bonding principles of Karp in the OPS structure of Salokatve. Applicants respectfully disagree for the reasons set forth below.

Karp relates to the construction of microfluidic devices. The assembly is formed by bonding a plurality of layers together. Figure 1A and 1B of Karp show a basic structure where the bottom layer 13 is solid, the middle layer 12 includes a channel 15 and the upper layer 11 includes openings 14. When the three layers are assembled, a fluid channel is formed.

In use, various fluids are passed through the channels for analytical purposes. The material to be tested is often dissolved in solvents. As can appreciated, in an analysis device, it would not be acceptable if the tested material or the solvents chemically reacted with the materials of the microfluidic device. For this reason, Karp suggests that the layers could be bonded together without using adhesives to "eliminate the potential compatibility problems between such adhesives and solvents and/or samples." (paragraph [0124]) To achieve this bond, Karp teaches that the structures should be compressed between glass platens and heated to about 150 degrees centigrade.

It should first be noted that the Karp application was filed on May 3, 2004, which is after the February 27, 2004, filing date of the subject application. Karp is a continuation-in-part of U.S. Patent No. 6,729,352. The parent patent however, does not include the same discussion of adhesiveless fabrication as is present in the cited Karp published application.

Paragraph [0124] of Karp refers to a prior publication to Covington (2003/0106799) which is stated to provide more details regarding adhesiveless fabrication. The Covington application was filed prior to applicants' filing date and is cited in the supplemental IDS filed concurrently herewith.

Covington makes it clear that the heating process that is used to create the adhesiveless bond is intended to melt and fuse the layers together. Due to the microsize features, Covington cautions that the layers should not be overheated "to avoid excessive polymer flow that would

result in microfluidic channel collapse." [0082] Therefore, Covington teaches that one should heat the materials to within a few percentage points of its "DSC melting point." [0082] The "DSC melting point" is defined in paragraph [0041] as the "temperature corresponding to the minimum heat flux in the solid/liquid phase change portion of the thermogram (heat flux versus temperature) of the polymer."

Thus, one skilled in the art reading Covington (and Karp '052 if it were prior art) would understand that a bonding method is disclosed where the parts are heated to the melting point (solid/liquid phase change) to cause the parts to fuse together.

One skilled in the art would never consider using such a method in an OPS laser to bond the heat sink to the semiconductor. As noted above, heating the semiconductor structure to a temperature anywhere near the melting point would destroy the device.

In contrast, applicants teach a bonding approach which does not rely on melting and indeed, does not necessarily require any heating. As described in the specification, the bond is achieved by tightly pressing together two surfaces that are extremely smooth and very clean so that atomic forces (van der Waal forces) will cause one surface to attract the other surface. In one embodiment, the assembly is heated, but to a temperature only a small fraction of the melting point.

In view of the above, it is respectfully submitted that one skilled in the art, looking for an approach to eliminate the adhesive bonding approach of Salokatve would never, ever consider the approach disclosed in Karp which relates to forming a microfluidic device out of polymer layers and wherein the polymer layers are heated to the melting point to fuse the layers together. Accordingly, the rejections of claims 1 to 6, 10, 11 and 13 must be withdrawn.

In the Office action, the Examiner also relied on patents to Zayhowski, Raymond and Pinneo. These secondary references are discussed in detail in applicants' previous responses. In summary, none of these secondary references can overcome the deficiencies of the primary references in anticipating or rendering obvious applicants' invention as defined by the independent claims.

Based on the above, it is respectfully submitted that all of the claims remaining in the application define patentable subject matter and allowance thereof is respectfully requested.

Respectfully submitted,

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